Soccer Ball Experiment                                Name(s):

Purpose:

Dissecting a soccer ball and performing a variety of material tests on the layers to understand what makes up a soccer ball.

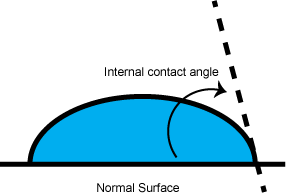
**Materials testing** is the measurement of the characteristics and behavior of such substances under various conditions.In this experiment, we will examine the different material tests on soccer ball layers.

*Material tests that we will conduct:*

* *Tension*
* *Measuring ductility or the indentability/elasticity*
* *Slipperiness*
* *Absorption and wettability*

Procedure:

1. Follow the teachers regarding the juggling competition.
2. Onto the dissection procedure, cut into the soccer ball with the knife. Cut the soccer ball into a few large pieces.
3. Use pliers with the outer layer to dissect it into multiple layers and experiment with the materials they are made out of. Think about how many different materials there are, and how you would describe them (e.g. texture, color, slippery-ness, absorption ability)
   1. Bonus: Can you identify what each of the materials is?
4. Cut the different materials of the soccer ball into 5cm by 3cm rectangles.
5. Starting off with our static tension and compression test, look into how difficult it is to pull apart each layer.
6. Observe and record your experiences of which layers were more difficult and why you think they were more difficult. Pull apart each material and notice how it elongates. Record your observations.
   1. Use a force gauge to record how much force it takes to pull/stretch. This quantifies resistance.
7. Examining the slipperiness and wettability of the materials now. Pick out all of the different material rectangles the soccer ball has (Hint: there should be 4)
   1. We will conduct two different tests: one water and one oil test.
8. To prepare for these tests, tape the different materials in a line close enough together but also allow for some space between each material.
9. Repeat steps 7 once more to prepare for the oil test.
10. Starting off with the water test: Use a cup and fill the cup with a little bit of water.
11. Use a pipette and drop 1 droplet of water onto the different types of materials.
12. Wait a few seconds before using your camera to take a picture of the water droplet on the side point of view.



1. Take pictures of all of the water droplets, and use a protractor on the picture that you took to find the internal contact angle (look above for example).
2. Now repeat this same idea, but with a new cup filled with oil.
3. Use a new pipette to drop the oil onto the new taped-up materials.
4. Record the visual differences and the internal contact angles for each of the water and oil droplets.
5. If you have time, soak the layers in the water cup for a few minutes. Then repeat the water contact angle measurements. Is there a difference to before they were soaked?

Discussion:

* What was your methodology in cutting apart this soccer ball? What was easy about it, and what was difficult? Why do you think that is?

* The outer layer in particular is made out of several materials. How many different materials did you end up identifying? What made them different?

* Some layers were easier to pull apart than others. What do you think contributed to why this is true? Why could it be better to have some that are easier to pull apart? (Consider these layers’ other properties.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Material |  |  |  |  |
| Force It Takes Materials to Change |  |  |  |  |
| Observations |  |  |  |  |

* What did you conclude about each material’s slipperiness? What are some potential advantages and disadvantages of this, particularly in a soccer setting?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Material |  |  |  |  |
| Water Droplet Angle |  |  |  |  |
| Oil Droplet Angle |  |  |  |  |

* Different materials absorb water differently. How do you think this factored into the order in which the materials are layered in the ball, and how do the materials contribute to the ball’s function?